02275 - TRENCHING, BACKFILLING AND COMPACTION OF UTILITIES

(Last revised 6/21/05)

SELECTED LINKS TO SECTIONS WITHIN THIS SPECIFICATION

PART 1 – GENERAL

The Contractor shall furnish all labor, materials, tools, and equipment to perform all work and services necessary for or incidental to the completion of all underground utilities as shown on the drawings and as specified in the Contract Documents.

Contractor shall be responsible for coordination of work of all other trades.

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this specification.

B. Section 01000 – GENERAL REQUIREMENTS.

C. Section 02200 – EARTHWORK.

D. Section 02510 – WATER DISTRIBUTION.

E. Section 02530 – SANITARY SEWER.

F. Section 02630 – STORM DRAINAGE.

G. Section 02740 – BASE COURSE AND PAVING.

H. Section 02920 – SEEDING, SODDING, AND GROUNDCOVER.

1.2 SUMMARY

A. This section includes:

1) Excavating and backfilling trenches for buried water, sewer, and storm drainage pipe systems, buried utility structures, and appurtenances.

2) Preparing subgrade for buried water, sewer, and storm drainage systems, buried utility structures and appurtenances.

B. Construction and materials related to this section but specified in other specification sections:

1) Section 01000 – *General Requirements*: Landscaping, Seeding and Groundcover, and Erosion Control.

2) Section 02200 – *Earthwork*: site clearing, grubbing, topsoil removal, tree protection, roadway, and paving.

1.3 DEFINITIONS

A. For the purposes of this specification, the following definitions refer to sanitary sewer, storm drainage and water distribution systems that come under the authority of the City of Fairfax, Virginia as specified within this section and other sections of this manual.

B. **Backfill**: Soil materials used to fill an excavated trench:

1) **Initial Backfill** (Select Earth Backfill): Backfill placed beside and 12 inches over the top of the pipe in a trench, including haunches to support sides of pipe.

2) **Final Backfill** (Common Earth Backfill): Backfill placed over the initial backfill to fill a trench.

C. **Bedding Course**: Layer placed over the excavated subgrade in a trench before laying pipe.

D. **Foundation Stone**: Clean well-graded stone, authorized by the Utilities Engineer, used to strengthen and/or provide support to an otherwise weak subgrade. Foundation stone is placed, and the subgrade improved before bedding stone is placed.

E. **Trench Rock Excavation**: Removal and satisfactory disposal of all unsuitable materials, which, in the opinion of the Utilities Engineer, cannot be excavated except by drilling, wedging, jack hammering or hoe ramming. It shall consist of undecomposed stone, hard enough to ring under hammer. All boulders containing a volume of more than ½ cubic yard and/or solid ledges, bedded deposits, unstratified masses and conglomerations of material so firmly cemented as to possess the characteristics of solid rock which cannot be removed without systematic drilling or hoe ramming will be classified as rock.

F. **Structures**: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

G. **Subgrade**: Surface or elevation remaining after completing the trench excavation or, the top surface of a backfill (stone or soil) immediately below the pipe conduit or pipe bedding, as applicable.

H. **Topsoil**: See Section 02930 – *Seeding, Sodding, and Groundcover*.

I. **Trench Borrow (Select)**: Trench borrow shall consist of approved material imported from off-site for use as fill or backfill required to be placed in trenches

either as initial select earth backfill or final common earth backfill. Trench borrow shall not be used until all suitable trench excavation material has been placed in the trench, unless authorized by the Utilities Engineer. Unless otherwise designated on the plans and in the Contract Documents, the Contractor shall make his own arrangements for obtaining borrow and pay all costs involved. Borrow material must be approved by the Utilities Engineer prior to use.

J. **Unclassified Excavation**: Removal and disposal of any and all material above subgrade elevation, except solid rock and undercut excavation, located within the limits of construction.

K. **Undercut Excavation**: Undercut excavation shall consist of the removal and satisfactory disposal of all unsuitable material located below subgrade elevation. Where excavation to the finished grade section results in a subgrade or slopes of muck, peat, matted roots, etc., the Contractor shall remove such material below the grade shown on the plans or as directed; and areas so excavated shall be backfilled with approved select earth borrow or stone as directed by the Utilities Engineer.

L. **Competent Person**: Competent Person means one who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.

M. The following are industry abbreviation for various pipe materials:

1) **CAP**: Corrugated Aluminum Pipe

2) **CI**: Cast Iron Pipe

3) **DIP**: Ductile Iron Pipe

4) **PCP**: Plain Concrete Pipe

5) **PVC**: Polyvinyl Chloride Plastic Pipe

6) **RCP**: Reinforced Concrete Pipe

1.4 SUBMITTALS

A. Submit product data and a sample of drainage fabric or separation fabric and fully document each with specific location or stationing information, date and other pertinent information.

B. **Material Test Reports**: Provide from a qualified testing agency test results and interpretation for compliance of the following requirements indicated:

1) Classification according to ASTM D2487 of each on-site or borrow soil proposed for backfill, unless otherwise directed by the Utilities Engineer.

2) Laboratory compaction curve according to ASTM D698 for each on-site or borrow soil material proposed for backfill.

C. **Bury Depth Computations**: Computations justifying pipe bury when bury depth exceeds the allowable depth shown in this specification. Provide method, applicable charts/graphs, print outs, assumptions, etc.

D. **Product Data**:

1) Each type of plastic/metallic locating tape

2) Stabilization/Separation fabric

3) Drainage Fabric

1.5 QUALITY ASSURANCE

A. **Geotechnical Testing Agency Qualifications**: An independent testing agency qualified according to ASTM E 329 to conduct soil materials and rock-definition testing as documented according to ASTM D 3740 and ASTM E 548.

B. Comply with all codes, laws, ordinances, and regulations of governmental authorities having jurisdiction over this part of the work.

C. The Contractor shall comply with the latest revision of the Virginia Occupational Safety and Health Standards for the Construction Industry as adopted by the Safety and Health Codes Commission of Virginia.

D. The Contractor shall comply with Virginia Department of Conservation and Recreation, Division of Soil and Water Conservation, "Virginia Erosion and Sedimentation Control Handbook," latest revision.

E. Comply with applicable requirements of NFPA 495, *"Explosive Materials Code."*

F. Comply with *"Gravity Sanitary Sewer Design and Construction*," ASCE Manuals and Reports on Engineering Practice – NO. 60, WPCF Manual of Practice NO. FD-5.

G. Comply with Uni-Bell PVC Pipe Association "*Handbook of PVC Pipe: Design and Construction,"* 3r ed. Dallas: UNI, 1991 for the installation of PVC piping, latest revision.

H. Materials and operations shall comply with the latest revision of the Codes and Standards listed below:

American Society for Testing and Materials

ASTM C 33	Concrete Aggregates.
ASTM D 698	Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3) (Standard Proctor).
ASTM D 1556	Standard Method of Test for Density of Soil in Place by the Sand-Cone Method.

ASTM D 1557 Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3) (Modified Proctor).

ASTM D 2049 Standard Method of Test for Relative Density of Cohesionless Soils.

ASTM D2167 Standard Method of Test for Density of Soil in Place by the Rubber-Balloon Method.

ASTM D 2487 Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).

ASTM D 2922 Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

ASTM D2937 Standard Test Method for Density of Soil in Place by the Drive-Cylinder Method

ASTM D 4253 Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.

ASTM D 4254 Test Method for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.

ASTM D 4318 Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

American Association of State Highway & Transportation Officials

AASHTO T99 The Moisture-Density Relations of Soils using a 5.5-pound Rammer and a 12-inch drop.

AASHTO T180 The Moisture Density Relations of Soils using a 10-pound Rammer and an 18-inch drop.

AASHTO M 145 The Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes.

American Water Works Association

AWWA C600 Installation of Ductile Iron Water Mains and Their Appurtenances.

1.6 STANDARD ABBREVIATIONS

ANSI American National Standards Institute

AREA American Railway Engineers Association

DCR Virginia Department of Conservation and Recreation

DEQ Virginia Department of Environmental Quality

MSDS	Material Safety Data Sheets
OHSA	Occupational Safety and Health Administration
VDH	Virginia Department of Health
VDOT	Virginia Department of Transportation
VPDES	Virginia Pollutant Discharge Elimination System

1.7 TESTING SERVICES

A. The Testing Laboratory shall be selected by the Contractor/Developer and approved by the Utilities Engineer and will be responsible for conducting and interpreting tests. The Testing Laboratory shall state in each report whether or not the test specimens conform to all requirements of the Contract Documents and specifically note any deviation.

B. Specific test and inspection requirements shall be as specified herein.

1.8 PROJECT CONDITIONS

A. **Demolition**: Demolish and completely remove from the site existing underground utilities indicated on the plans to be removed.

B. **Environmental – Wetlands**: Before crossing or entering into any jurisdictional wetlands, Contractor shall verify whether or not a wetlands permit has been obtained for the encroachment and whether special restrictions have been imposed. Care shall be taken to prevent draining or otherwise destroying non-permitted wetlands. Restore as stated on either the project drawings, the contract documents, and/or as noted in the permit. All crossings, disturbance, and encroachments into wetlands shall be subject to US COE and Virginia Department of Environmental Quality (DEQ) approval and permitting requirements and conditions.

C. **Environmental – Buffer Crossing Requirements**: Before crossing streams or ditches or working within 100 feet of surface waters, the Contractor shall verify whether the utility line is exempt or if a permit has been obtained to encroach into such buffers or other such regulated waters, and to what extent work is permitted to occur. Unless otherwise permitted, shown on the contract drawings, or exempted, water and sewer crossing stream, river, pond or lake buffers are to be as near perpendicular as possible (the crossing is considered to be perpendicular if it intersects the stream or surface water between an angle of 75 and 105 degrees). Adhere to all of the Best Management Practices in accordance with local and state regulations.

D. **Safety**

The Contractor shall keep the surface over and along the trenches and other excavation in a safe and satisfactory condition during the progress of work.

1.9 COORDINATION

A. At the direction of the Director of Utilities, temporary pumping/bypass of sewerage flow may be required to be provided. See Section 02530 - *Sanitary Sewer* for bypass pumping requirements and procedures.

B. Coordinate tie-in to municipal sewer mains and manholes with the Utilities Engineer.

C. When traffic signals or their appurtenances are likely to be damaged or interfered with as a result of the construction, coordinate temporary operation with the Public Works Director and VDOT, as applicable. Provide a minimum of 48 hours notice prior to anticipated disturbance or interruption.

D. **Benchmark/Monument Protection**: Protect and maintain benchmarks, monuments or other established reference points and property corners. If disturbed or destroyed, replace at own expense to full satisfaction of Owner/City of Fairfax.

E. **Valve operation/interruption of water service**: Water valves shall be operated by the Department of Utilities' staff only. Contact the Department of Utilities at 703.385.7991 to coordinate interruption of services and/or operation of valves. After hours, call 703.385.7924. Adequate notifications to water customers will be given by the Contractor prior to any interruption of service. Service is to be continuously maintained to customers in the project areas except for the minimum amount of time required to make connections with the existing system. Only in the case of an emergency may a valve be closed by a Contractor. Records shall be kept of any vales closed during an emergency and the Department of Utilities shall be notified of the specific valves closed at the earliest reasonable time following such valve closure.

   If interruption is necessary, the interruption shall be arranged to occur at such a time to cause the least disruption and minimize loss of service. At the direction of the Utilities Engineer, temporary service may be required to be provided. Before shutting off any main, residents are to be notified by a City of Fairfax representative in writing at least 24 hours in advance of cut off. The Contractor shall provide assistance to the City of Fairfax in notification distribution. The City of Fairfax shall be notified at least 48 hours in advance of request for operation of valves and making either a wet tap or cut-in.

F. Before digging in the ground for any construction, call MISS UTILITY at 1-800-552-7001 to have all underground utilities marked in order to prevent damage or disruption of services. Other utilities that may have potential conflicts are:

   Other Private Utilities:

Utility	Company	Phone
Electricity	Dominion Virginia Power	1-888-667-3000
Gas	Washington Gas	1-800-752-7520
Phone	Bell Atlantic/Verizon	703-954-6222
Cable TV	Cox Communication	703-378-8422

E. No blasting is permitted within the City Limits and within 50 feet of the City's transmission main in Fairfax and Loudoun Counties.

F. **Permits for Construction on State Highways and Streets**: The Virginia Department of Transportation requires a permit for work to be performed on State Highways. Provisions for obtaining such permits are set forth in the "Manual on Permits, Virginia Department of Transportation, Richmond, Virginia," latest revision. No work will be accepted by the Department of Utilities that has not been accepted or approved as satisfactory by the Department of Transportation.

G. **Permits for Construction on City Streets**: All permits as required by the City of Fairfax Department of Public Works shall be obtained, and their conditions adhered to, for all work to be performed on City Streets and Rights of Way.

H. **Repair of pavement markings**: When cuts are made through any paved surface and the cuts extend through the pavement markings, the replaced pavement shall be marked to match the existing.

1.10 PUBLIC COORDINATION

The Contractor shall at all times so conduct his work as to insure the least possible inconvenience to the general public and the residents in the vicinity of the work. Fire hydrants on or adjacent to the work shall be kept accessible to fire fighting equipment at all times. Temporary provisions shall be made by the Contractor to insure the proper functioning of all gutters, sewer inlets, drainage ditches, and irrigation ditches, which shall not be obstructed except as approved by the City Engineer.

Fire hydrants that are either to be abandoned or are not in service shall be bagged with yellow bags. Coordination of bagging shall be coordinated with the City.

1.11 TRAFFIC CONTROL

The Contractor is responsible for Traffic Control in accordance with Section 01000 – *General Requirements*.

1.12 EROSION AND SEDIMENTATION CONTROL AND VPDES REQUIREMENTS

The Contractor shall comply with the requirements of the Virginia Department of Conservation and Recreation, Division of Soil and Water Conservation, **Virginia Erosion and Sedimentation Control Handbook**, latest edition. Construction methods shall minimize sedimentation and erosion.

It is the Contractor's responsibility to periodically monitor the Stormwater Discharge Outfall points at the specified frequency and maintain reports as required by the Virginia Department of Environmental Quality, outlined in the Virginia Pollutant Discharge Elimination System Permit Regulation (VAC 25-31, et seq.).

PART 2 – PRODUCTS

2.1 SOIL, BEDDING AND BACKFILL

2.1.1 MATERIAL CLASSIFICATION

A. **Backfill Around Structures**: Backfill shall be approved by the City Engineer and shall be free from large or frozen lumps, wood, or rocks more than 3 inches in their greatest dimension or other extraneous material. Porous backfill shall

conform to the requirements of applicable sections of the VDOT *Road and Bridge Specifications.*

B. **Bedding Material**: VDOT #57, #68, or #78 stone.

C. **Coarse Aggregate Backfill**: See applicable VDOT *Road and Bridge Specifications* for properties and gradation of VDOT #57 stone.

D. **Common Earth (Trench) Backfill**:

1) **Satisfactory Soils**: ASTM D2487 soil classification group (Unified Soil Classification System) GW, GP, GM, SW, SW, SM, SC, ML, and CL (Classes IA, IB, II, III and IVA soils; see **Standard Detail 511.01**) or a combination of these group symbols; free of rock or gravel larger than 3 inches in any dimension, debris, waste frozen materials, vegetation, and other deleterious matter.

2) **Unsatisfactory soils**: ASTM D 2487 soil classification group CH, MH, OH, OL and PT (Classes IVA & V soils; see **Standard Detail 511.01)**; soils which contain rock or gravel larger than 3 inches in any dimension, debris, waste frozen materials, vegetation, clumps of clay larger than 3 inches in any dimension, and other deleterious matter. Unsatisfactory soils also include satisfactory soils not maintained within +/- 3% of optimum moisture content at time of compaction, unless otherwise approved by the City Engineer.

E. **Dense Graded Aggregate Backfill**: VDOT #21A stone.

F. **Excavation**: All excavation material shall be classified as either Rock or Unclassified Earth Excavation.

G. **Flowable Fill Concrete Backfill** (Controlled Low Strength Material): Concrete strength shall be liquid enough to flow, be self-leveling, excavatable, and have a minimum 28 day compressive strength of 30 psi but not more than 100 psi. Non-excavatable flowable fill concrete shall have a minimum 28-day compressive strength of 125 psi but no more than 200 psi (to be excavatable by machine equipment). Materials shall comply with the recommendations within chapter 3 of ACI 229, latest revision, which include cement, aggregates, fly ash, water, admixtures, slag and other non standard materials).

Excavatable is an application where it may be necessary to remove the flowable fill at a later date. Non-excavatable is an application where it is not necessary to remove or otherwise excavate the flowable fill at a later date.

H. **Foundation Stone**: Foundation/Trench Stabilization Material: VDOT #1 or #2 stone.

I. **Select Initial Earth Backfill**: Select earth backfill shall be free of debris, roots, frozen materials, organic matter, rock, or gravel larger than 1 inch in any dimension, or other harmful matter and shall generally meet Section 207 – *Select Material* of the VDOT *Road and Bridge Specifications,* latest revision, for properties and gradation. Sand and rock dust are acceptable materials.

J. **Structures, Backfill around**: Backfill shall be approved by the City Engineer and shall be free from large or frozen lumps, wood, or rocks more than 3 inches

in their greatest dimension or other extraneous material. Porous backfill shall be either VDOT #67, 57, or #357 clean stone.

K. **Topsoil**: See Section 02920 – *Seeding, Sodding, and Groundcover*.

2.1.2 PIPE BEDDING DEFINITIONS

A. **Pipe Bedding Definitions**

1) **Class D Bedding** is that condition existing when the ditch is excavated slightly above grade by excavation equipment and cut to finish grade by hand. Bell holes are dug, to prevent point loading the pipe bells, so that pipe bears uniformly upon the trench bottom. Existing soil should be shovel sliced or otherwise compacted under the hunching of the sewer pipe to provide some uniform support. Soil is tamped to 90% of the maximum Standard Proctor dry density around the pipe to a point one foot above the pipe. The remainder of the soil to the ground surface is to be compacted to the density specified in Table 2275.2. In poor soils, granular bedding material is generally a more practical, cost effective installation. The bedding factor for class D bedding is 1.1.

2) **Class C Bedding** is that condition where the sewer pipe is bedded in compacted granular material. The granular bedding has a minimum thickness of one-eighth the outside sewer pipe diameter, but not less than 4 inches or more than 6 inches, and shall extend up the sides of the sewer pipe one-sixth of the pipe outside diameter. The remainder of the sidefills, to a minimum depth of 6 inches over the top (exterior crown) of the pipe, consists of lightly compacted backfill. The remainder of the soil to ground surface is to be compacted to the density specified in Table 2275.2. The bedding factor for class D bedding is 1.5.

3) **Class B Bedding** is that condition where the sewer pipe is bedded in carefully compacted granular material. The granular bedding has a minimum thickness of one-eighth the outside sewer pipe diameter, but not less than 4 inches or more than 6 inches, between the barrel and the trench bottom, and covering the full width of the trench.

The haunch area of the sewer pipe must be fully supported; therefore, the granular material should be shovel sliced or otherwise compacted under the pipe haunch to the springline of the pipe. Both granular haunching (to the springline) and initial backfill to a minimum depth of 12 inches over the top of the sewer pipe should be placed and compacted. The initial backfill material, to a depth of 12 inches over the top of the pipe, should be compacted to no less than 90% of the maximum Standard Proctor dry density. The remainder of the soil to the ground surface is to be compacted to the density specified in Table 2275.2. The bedding factor for class B bedding is 1.9.

4) **Class B-1 Bedding** (*PVC pipe applications*) is the same as Class B Bedding except that granular backfill is placed to the ***top of the pipe*** rather than to the springline of the pipe. The remainder of the soil to the ground surface is to be compacted to the density specified in Table 2275.2.

5) **Class A Bedding** is that condition when the sewer pipe is bedded in a cast-in-place cradle of either plain or reinforced concrete having a thickness equal

to one-fourth the inside pipe diameter, with a minimum of 4 inches and a maximum of 15 inches under the pipe barrel and extending up the sides for a height equal to one-fourth the outside pipe diameter. The cradle width shall have a width at least equal to the outside diameter of the sewer pipe barrel plus 8 inches. The bedding factor for class B bedding is 2.2.

The haunching and initial backfill material above the concrete cradle should be crushed stone or a well graded granular material and carefully compacted to 12 inches above the crown of the sewer pipe. The remainder of the soil to the ground surface is to be compacted to the density specified in Table 2275.2.

2.2 MISCELLANEOUS

2.2.1 GEOTEXTILE FABRIC

Geotextile fabric shall be protected from mud, dirt, dust, sunlight, and debris during transport and storage. Material shall be inert to commonly encountered chemicals; resistant to mildew, rot, insects, and rodents; and biologically and thermally stable. Geotextile fabric for subsurface installation shall not be exposed to direct sunlight for more than 24 hours before or during installation. All geo-fabric to be used within the right-of-way of a City street must be approved by the Public Works Director.

Filter Fabric for riprap, soil stabilization fabric, fabric for subsurface drains and silt fence shall comply Section 245, *Geosynthetics* of VDOT *Road and Bridge Specifications*.

2.2.2 LOCATING TAPE

A. **Metallic Locating Tape**

Acid and alkali resistant polyethylene film tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:

Blue: Water Systems
Green: Sewer systems

2.2.3 DEFORMED REINFORCING STEEL

Reinforcing Steel bars shall meet ASTM A615, grade 60, latest revision.

2.2.4 WELDED WIRE FABRIC

Welded wire fabric shall meet ASTM A185, latest revision.

PART 3 – EXECUTION

3.1 PREPARATION

3.1.1 GENERAL REQUIREMENTS APPLYING TO ALL AREAS

A. Contractor shall plan construction to minimize disturbance to properties adjacent to the sewer, water, and storm lines.

B. The City Engineer reserves the right to limit the width of land to be disturbed and to designate on the drawings or in the field certain areas or items within this width to be protected from damage.

C. **Access and Haul Roads**: Any grading or excavation required for equipment travel during the course of construction as well as erosion control, access or haul road installation and removal, restoration, seeding and ground cover shall be provided by the Contractor.

D. The Contractor shall be responsible for damage to areas or items designated by the City Engineer to be protected. Repairs to, replacement of, or reparations for areas or items damaged shall be made at the Contractor's expense to the satisfaction of the City Engineer before acceptance of the completed project.

E. The Contractor shall protect all buildings, structures, and existing utilities located along the utility line. Hand trenching, shoring, or other methods may be required at no additional cost.

F. Any fences disturbed by the Contractor shall be repaired to a condition equal to or better than their original condition or to the satisfaction of the City Engineer at no additional cost.

G. Contractor shall limit width of disturbed area through garden areas to a width absolutely necessary for construction of utility line.

H. Contractor shall obtain written permission from property owners for use of any access other than ones located within rights-of-way. Written permission shall contain conditions for use and restoration agreements between property owner and Contractor. No additional compensation will be made for such access.

I. All areas disturbed shall be restored to a condition equal to or better than their original condition and shall be graded to drain.

J. The Contractor shall replace or repair all damaged or destroyed hedgerows and property corners. Protection of and restoration of damaged or destroyed property corners shall be in accordance with the requirements of Section 01000 – *General Requirements,* Construction Staking.

K. When a property owner requests that a tree(s) within construction limits remain, a waiver shall be signed between the property owner and the City.

3.1.2 CONSTRUCTION LIMITS

A. Contractor shall not disturb any areas outside the limits contained in this section without the express written permission from the City Engineer.

B. Except as indicated on the plans, no "clear cutting" of timber shall be permitted within the construction limits. Contractor shall make select cutting of trees, taking smallest trees first, that are mandatory for the construction of the utility

line. The decision of the City Engineer shall be final on the determination of which trees are to be cut.

C. The widths measured from the centerline of the water or sewer lines shall be as shown on the contract drawings. The Contractor shall protect all areas outside these construction limits unless written variations are granted by the City Engineer.

3.1.3 CLEARING AND GRUBBING

A. **Description**: This work shall consist of clearing, grubbing, removing, and disposing of all vegetation and debris within the limits of construction, as designated on the plans or as required by the City Engineer. The work shall also include the preservation from injury or defacement of all vegetation or objects designated to remain. Clearing shall consist of cutting, removal, and satisfactory disposal of all trees, down timber, brush, rocks, projected roots, stumps, rubbish, laps, and other material within easement.

B. A preconstruction meeting shall be held with appropriate forestry personnel, if required, and the City prior to any clearing. The City Engineer may require tree protection fencing in sensitive areas, where specifically identified trees are desired to be protected, and when required by the landscape ordinance.

C. The Contractor shall provide barricades, fences, coverings, or other types of protection necessary to prevent damage to existing improvements, not indicated to be removed, and improvements on adjoining property. All improvements damaged by this work shall be restored to their original condition or to a condition acceptable to the owner or other parties or authorities having jurisdiction. Trees and shrubs that are to remain within the construction limits will be indicated on the drawings or conspicuously marked on site. Unless otherwise noted, trees within the construction limits shall become the property of the Contractor and shall be removed from the site.

D. Debris from the site shall be removed in such a manner as to prevent spillage. Keep pavement and area adjacent to site clean and free from mud, dirt, dust, and debris at all times.

E. The method of stripping, clearing, and grubbing the site shall be at the discretion of the Contractor. However, all stumps, roots and other debris protruding through the ground surface or in excavated areas shall be completely removed and disposed of off the site by the Contractor.

F. **Stripping of Topsoil**: Remove the existing topsoil to a minimum depth of 6 inches or to the depth encountered from all areas in which excavation will occur. The topsoil shall either be stored in stockpiles separate from the excavated trench material if the topsoil is to be respread or otherwise disposed of off-site. Topsoil stockpiles shall be graded to freely drain surface water, and shall have a silt fence placed around the base of the stockpile.

G. **Disposal**: All brush, tree tops, stumps, and debris shall be hauled away from site or otherwise disposed of in a manner acceptable to the City Engineer. The Contactor shall clean up debris resulting from clearing operations continuously with the progress of the work and remove promptly all salvageable material that

becomes his property and is not to be reused in construction. Sale of material on the site is prohibited.

Disposal of cleared material shall be in accordance with all local and state laws. Trees cut down on the construction site will be hauled away from the site for proper disposal unless instructed otherwise by the City. Stumps of trees cut down outside of the excavation area will be removed. Perishable material shall not be disposed of at the construction site. Brush, laps, roots, and stumps from trees shall be disposed of in a State approved and permitted land clearing and inert debris type landfill. The Contractor will be responsible for obtaining all applicable permits and paying all fees for the disposal of excess material.

H. Prior to commencement of clearing, Contractor shall notify the City 48 hours in advance.

I. **Protection of Trees and Vegetation**:

Contractor shall protect existing tress and other vegetation indicated by the City Engineer to remain in place against limb, bark or root damage such as cutting, breaking, or skinning of roots, skinning and bruising of bark, smothering of trees by stockpiling construction materials or excavated materials within drip line, excess foot or vehicular traffic, or parking of vehicles within drip line. When such damage does occur, all rough edges of scarred areas shall be removed in accordance with accepted horticultural practices.

Trees and shrubs that are to remain within the construction limits will be indicated on the drawings or conspicuously marked on site.

Carefully and cleanly cut roots and branches of trees indicated to remain where the roots and branches obstruct construction of the utility line. If directed by the City Engineer, the Contractor shall provide protection for roots and branches over 1 ½ inches diameter that are cut during construction operations. Coat the cut faces with emulsified asphalt, or other coating especially formulated for horticultural use on cut or damaged plant tissues. Temporarily cover all exposed roots with wet burlap to prevent roots from drying out. Provide earth cover as soon as possible.

Damaged trees and vegetation designated to remain shall be repaired or replaced at Contractor's expense in a manner acceptable to the City Engineer if they are damaged by construction operations. Repair tree damage as directed by a qualified tree surgeon.

J. All brush, tree tops, stumps, and debris shall be hauled away and disposed of in accordance with applicable laws and regulations. The Contactor shall clean up debris resulting from clearing operations continuously with the progress of the work and remove promptly all salvageable material that becomes his property and is not to be reused in construction. Sale of material on the site is prohibited. Debris from the site shall be removed in such a manner as to prevent spillage. Keep pavement and area adjacent to site clean and free from mud, dirt, dust, and debris at all times. Unless otherwise noted, all trees with diameters of 6 inches or larger, measured at the base, cut on any project shall be cut into fireplace lengths, 24 inches, stacked within the "construction limits" at a location suitable to the property owner. Contractor shall not remove any wood from this

project without written authorization from the City Engineer. No additional compensation shall be made if removal of trees from property is required.

K. **Specific requirements applying to developed subdivision/lots**

1) All trees located beyond 15 feet of the centerline of water, sewer or storm drainage lines shall be protected by the Contractor. The City Engineer reserves the right to designate other trees located closer to the centerline for protection where possible.

2) All shrubs, hedges, or other ornamental plantings located along the line shall be protected or removed and replanted by the Contractor, and survival guaranteed through the project's warrantee period. If the plantings fail to survive, they shall be replaced with specimens of like size whenever available.

3) The Contractor shall protect septic systems or springs located beyond 15 feet from the centerline of the line. Any septic system damaged by the Contractor will be maintained and pumped by the Contractor until such time as it is repaired to the satisfaction of the Fairfax County Department of Environmental Health or the property is connected to the sanitary sewer.

4) Contractor shall grub only brush, roots, and stumps of removed trees. Damage to lawns shall be kept to an absolute minimum necessary for construction.

5) Excavated rock shall be removed from the site unless otherwise ordered by the City Engineer.

6) Restoration and fine grading shall follow within 15 calendar days from the time an area is disturbed or within 1000 feet from the immediate work site, which ever occurs first. Seeding shall follow as ordered by the City Engineer

L. **Specific requirements applying to undeveloped areas**

1) In wooded areas, the clearing shall be 15 feet on each side of pipe, unless indicated differently on the City of Fairfax approved construction drawings, in which case, the work shall be confined to the limits defined on the plans. All permanent easements shall be fully cleared. All trees 12 inches in diameter or larger located beyond 15 feet of the centerline of the water or sewer line shall be protected unless contractor obtains written authorization from the City Engineer to remove them. The City Engineer reserves the right to designate select trees located closer to the centerline for protection where possible.

2) In areas where livestock and pets are is kept, the Contractor shall notify property owner prior to commencing work and keep owner advised of progress of work. Fences shall be kept secure at all times and livestock and pets protected from open ditches, machinery, and other hazards.

3) Restoration, fine grading, and permanent seeding shall follow within 15 working days or 30 calendar days, whichever is shorter, from the time an area is disturbed. Trench disturbance shall not exceed more than 1000 feet

from the immediate work site without the approval/consent of the City Engineer. See Section 02920 – *Seeding, Sodding, and Groundcover*.

3.1.4 PROTECTION OF EXISTING UTILITIES AND STRUCTURES

A. **Subsurface obstructions**

1) **Subsurface obstructions**: Take necessary precautions to protect existing utilities from damage due to any construction activity. The Contractor shall locate existing utilities, culverts, and structures (above or below ground), before any excavation starts and coordinate work with utility companies. The Contractor shall be responsible for notifying utility companies when working within the vicinity of the existing utilities. Omission from or inclusion of located utility items on plans does not constitute non-existent or definite location. Even though for convenience, the utility may be shown on the plans, the Contractor is responsible for and shall call for utility location a minimum of 48 hours prior to excavations. Contact underground damage protection services MISS UTILITIES at 1-800-552-7001. Secure and examine local utility surveyor records for available location data including building service lines.

2) Unless shown to be removed, protect active utility lines shown on the drawings or otherwise made known to the Contractor prior to trenching. In excavating, care must be taken not to remove or injure any subsurface structure. All existing gas pipes, water pipes, steam pipes, telephone lines, cable TV lines, electrical conduits, sewers, drains, fire hydrants, and other structures which, in the opinion of the utility company, do not require relocation shall be carefully supported, shored up, the flow maintained, if applicable, and the line/main protected from damage by the Contractor. If damaged, the Contractor shall give immediate notice to the proper authorities. The utility shall be restored, at the Contractor's expense, by the appropriate utility to original or better condition. Where pipes, conduits, or sewers are removed from the trench leaving dead ends in the ground, such ends shall be carefully plugged or bulkheaded by the Contractor at the Contractor's expense. The Contractor shall be responsible for any damage to persons or property caused by such breaks.

3) The Contractor shall be responsible for anticipating and locating underground utilities and obstructions. When construction appears to be in close proximity to existing utilities, the trench(es) shall be opened a sufficient distance ahead of the work or test pits made to verify the exact locations and inverts of the utility to allow for changes in line and grade.

4) If active utility lines are encountered, and are not shown on the Drawings or otherwise made known to the Contractor, promptly take necessary steps to assure that service is not interrupted.

5) Should it become necessary to move the position of any underground structure, when approved by the Public Works Director and the Utilities Engineer, the Contractor may be required to do such work and shall be paid on a force account basis or on an extra work basis.

6) If existing utilities are found to interfere with the permanent facilities being constructed under this Section, immediately notify the Utilities Engineer and Public Works Director and secure their instructions.

7) Do not proceed with permanent relocation of utilities until written instructions are received from the Utilities Engineer.

B. **Protection of Surface Features**

1) Whenever the utility line is to be placed in or near a paved street, the contractor shall provide pads or take necessary precautions to protect the pavement from damage by the construction equipment. Pavement damaged by cleated or tracked equipment, or by any other means, shall be repaired by the contractor at his expense.

2) Where a utility line is in an existing paved area, the Contractor shall use care to cut in sharp, neat lines ahead of the excavating/ditching equipment and parallel to the pipe on each side as may be applicable. If the existing road to be cut is located within another jurisdiction other than the City of Fairfax or within VDOT rights of way, the Contractor is responsible for contacting the local representative or VDOT, respectively about pavement repair/replacement.

3) Avoid overloading or surcharge a sufficient distance back from edge of excavation to prevent slides or caving. Maintain and trim excavated materials in such manner to be as little inconvenience as possible to public and adjoining property.

4) Provide full access to public and private premises, to fire hydrants, at street crossings, sidewalks and other points as designated by the Public Works Director and Utilities Engineer to prevent serious interruption of travel.

5) Protect and maintain benchmarks, monuments, or other established points and reference points and if disturbed or destroyed, replace items to full satisfaction of the Public Works Director and Utilities Engineer and the jurisdictional agency.

C. **Procedures for repairing damaged utility services**

1) If a located service is interrupted as a result of work under this Section, immediately restore service by repairing the damaged utility at no additional cost to the City.

2) **House services**: If a service pipe supplying water or gas to an adjoining house is broken, the Contractor shall repair same at once and at his expense. The City may, at the Contractor's expense, repair any such service without prior notice to the Contractor.

3.1.5 PROTECTION OF PERSONS AND PROPERTY

A. Barricade open holes and depressions occurring as part of the work, and post warning lights on property adjacent to or part of public access.

B. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, washout, and other hazards created by operations under this or other related sections.

C. **Protection and Restoration of Property:** The contactor shall not enter upon private property for any purpose without first obtaining permission. He shall use every precaution necessary to prevent damage or injury to any public or private property, trees, fences, monuments, and underground structures, etc., on and adjacent to the site of the work. He shall protect carefully from disturbance or damage all land monuments and property markers until an authorized agent has witnessed or otherwise referenced their locations, and shall not remove them until directed.

The contractor shall be responsible for all damage or injury to property of any character resulting from any act, omission, neglect, or misconduct in his manner or method or executing said work, from his nonexecution of work, or from defective work or materials, and he shall not be released from said responsibility until the work shall have been completed and accepted.

When or where any direct or indirect damage or injury is done to public or private property by or on account of any act, omission, neglect, or misconduct in the execution of the work, he shall restore such property, at his own expense, to a condition equal to or better than that existing before such damage or injury was done, by repairing, rebuilding, or otherwise restoring, and may be directed or he may make good such damage or injury in an acceptable manner.

The Contractor shall, at his own expense, sustain in their places and protect from direct or indirect injury all pipes, poles, conduits, walls, roadways, buildings, and other structures, utilities and property in the vicinity of his work. Such sustaining and supporting shall be carefully done by the Contractor and as required by the Company or party owning the structures or Agency controlling it. The Contractor shall take all risks attending the presence or proximity of pipes, poles, conduits, walls, thereof and any costs associated will be deducted from any monies due the Contractor. Failure of the City Engineer or his/her authorized representative to direct the correction of unsafe conditions or practices shall not relieve the Contractor of his responsibility hereunder.

3.2 TRENCH EXCAVATION

3.2.1 GENERAL

A. **Classification of Excavated Material**: All excavated material shall be classified as either earth or rock. Prices bid for the various sizes of pipe shall include excavation and backfilling; such excavation shall be classified as earth. Rock excavation shall be paid for as a separate item.

B. Remove all material of whatever nature, including but not limited to clay, silt, and gravel. Provided the material meets the requirements of paragraph 2.1.1 *Material Classification*, subparagraph D, *Common Earth Backfill*, material of a compactable nature that can be re-used as trench backfill shall be replaced and re-compacted to the requirements set forth in these specifications.

C. **Unsuitable Material and Wasting**: When directed by the Owner's Engineer or the Utilities Engineer, unsuitable material in the trench shall be removed to an appropriate depth and width. At the Contractor's expense, dispose of all unsuitable material, of whatever nature, to a site which legally can accept such material as fill. Adhere to all applicable laws and ordnances regarding permitting of waste site, erosion control, zoning, etc. as may be applicable.

D. Excavation shall be performed in accordance with OSHA Standard 29 CFR Part 1926, OSHA Subpart P "*Excavation and Trenching.*"

E. **Sanitary and Storm Sewer Alignment and Grade**: Offset stakes set at each manhole, catch basin, or curb inlet shall indicate the line and grade of the sewer. Alignment and grade of the pipe by the Contractor shall be established by laser beam. The contractor shall employ personnel experienced in the use of laser beams. The alignment and grade of the sewer shall be constructed as indicated on the approved plans. Prior to making changes in the field, the Utilities Engineer shall approve any change in grade or alignment, which deviates from the approved plans.

F. Concrete collars shall be installed on lines with slopes 20% or greater.

G. Material of an uncompactable nature, material unsatisfactory for backfill, trash and excess material shall be removed from project site and disposed at the Contractor's expense. Where removal of unsatisfactory material is due to negligence on the part of the Contractor (i.e. resulting from inadequate shoring or bracing, failure to dewater, improper material storage exposing it to rain or flooding, or other failure to meet specified requirements), work shall be performed at no additional cost to the City. If additional material is required, the Contractor shall supply same from an approved borrow pit at no additional cost the City.

3.2.2 PIPE COVER

A. **General**: Where lines traverse public property or are subject to other governmental or utility company jurisdiction, provide depth, bedding, cover, and other requirements as set forth by legally constituted authority having jurisdiction, but in no case less than the depth shown in the Contract Documents.

B. **Minimum Cover**: Unless shown otherwise on the construction documents, provide minimum trench depth indicated below to maintain a minimum cover over the top of the installed item. Minimum cover on pipe is measured perpendicular from top of pipe or fittings to original ground or proposed finished grade as applicable and shall be per Table 2275.1, below. Where the minimum cover is not provided, either use Ductile Iron Pipe or encase the pipe(s) in concrete as indicated. Provide concrete with a minimum 28-day compressive strength of 3000 psi.

Table 2275.1 Minimum Cover *above top* of Main Pipe Lines			
Utility	**Condition**		
	Subject to vehicular traffic	**NOT subject to vehicular traffic**	**With Concrete Encasement**
Sanitary Sewer	36[b] inches (use DIP if < 36 inches of cover)	36[b] inches (use DIP if < 36 inches of cover)	As Designed
Sewer Services	At depth shown on plans but no less than 36[b] inches	At depth shown on plans but no less than 12[b] inches	As Designed
Water Distribution	48[a] inches for mains < 16 inches and 54 inches for mains > 16 inches	36[a] inches	18 inches (see paragraph C, regarding encasement)
Water services	36[a] inches	30[a] inches	As Designed
Storm Drainage	As designed but no less than 12[c] inches for reinforced concrete pipe	As designed	As Designed

[a]**Minimum/Maximum Cover for Water Pipe**: The Utilities Engineer must approve all installations of water mains with less than 36 inches of cover.

[b]**Minimum/Maximum Cover for Sewer Pipe**: The Utilities Engineer must approve all installations of sewer lines with 24 inches of cover or less or with greater than 18 feet of cover. Ductile iron pipe is required where depth of pipe exceeds 18 feet or the line is placed in fill.

[c]**Minimum/Maximum Cover for Storm Drainage Pipe**: The Public Works Director must approve all installations of storm drainage lines in areas subject to traffic load with less than 12 inches of cover or with greater than 12 feet of cover. The pipe class, trench width, and/or the bedding class shall be modified for the depths exceeding 12 feet of cover to accommodate the extra depth/loads. Pipe subject to vehicular traffic shall be reinforced concrete pipe. No plain concrete pipe is permitted in traffic areas.

C. Water lines which have no more than 36 inches of cover at ditch or culvert crossings may be required by the Utilities Engineer to be encased in concrete for a length of at least 5 feet beyond each side of the ditch or culvert.

3.2.3 TRENCHING

A. **General**: The trench for gravity pipe shall be excavated to conform to **Standard Details 511.01** (water and drainage) and **531.03** (sewer) as applicable. Where it is necessary to remove existing pavements, prepared road surfaces, sidewalks and curbs, these structures/surfaces must be replaced by the Contractor. When making a pavement cut, the Contractor shall use care to saw cut in sharp, neat lines ahead of the excavating/ditching equipment and parallel to the pipe on each side as may be applicable. Edges of existing pavement shall be re-cut and trimmed to square, straight edges after the pipe system has been installed and prior to placement of the new base and pavement.

All trenching shall be open-cut from the surface. No tunneling or boring will be allowed without the consent of the Utilities Engineer. All trenches shall be excavated to the lines and grades as shown on the plans. Where utility lines are in an existing paved area, the edges of the pavement for the utility line shall be cut in a straight line, parallel to the pipe.

Trenches shall be excavated in straight lines, in general, following the contour of the ground, and shall be accurately graded in order to establish a true elevation of the invert of the pipe. Trenches for water lines may be curved within the limits of curvature of the pipe as allowed by AWWA C600. In no case shall the trench alignment exceed the allowable vertical or horizontal pipe deflection of offset recommended by the pipe manufacturer.

1) **Trench Width**: The sides of trench shall be uniform and vertical. The width of the trench at the top of the pipe shall be a width that will permit the proper construction of joints and compaction of backfill around the pipe and shall be equal to the largest outside diameter of the pipe plus 8 inches on each side of the pipe, measured at the top of the pipe. The sides of the trenches shall be vertical unless otherwise approved by the Utilities Engineer. Vertical walls should project at least 2 feet above the top of the pipeline laid to existing construction grade unless the finished grade fill depth is less than 2 feet. Lowering trench wall height may necessitate a change in either pipe or bury classification. Notwithstanding, this section is subject to OSHA guidelines and regulations regarding trench protection and shoring.

   Every effort shall be made to maintain the width of the pipe plus 16 inches but trench width must also be wide enough to provide adequate space for laying and connecting pipe and appurtenances. Sufficient space shall be allowed at the joints for the free use of wrenches for tightening of bolts.

   The minimum trench width should generally be no less than 36 inches in order to accommodate a “Rammax” type tamp.

   In excavating for the trench, it is essential that the trench bottom be uniform in grade and remains static during backfilling and under all subsequent trench conditions. To insure a uniform depth of stone, the grade of the bottom of the trench shall be graded to within 0.04 foot (1/2-inch) of the plan specified grade. The stone shall be graded to the same tolerance..

2) **Trench Depth**:

   a. **General**: All trenches shall be excavated to accommodate the bedding as shown in **Standard Details 511.01** (water and drainage) **and 531.03** (sewer) as applicable. No extra compensation will be made for stone bedding used to bring the trench up to grade other than that required in

   b. **Water**: Trench depth shall generally conform to that shown on the plans and in conformity to the requirements of Table 2275.1, *Minimum Cover above top of Main Pipe Lines*.

   c. **Gravity sewer**: Excavate to the depth and grades shown on the plans. Trench depth shall generally conform to the requirements of Table 2275.1, *Minimum Cover above top of Main Pipe Lines*.

d. **Storm drainage**: Excavate to the depth and grades shown on the plans. Trench depth shall generally conform to the requirements of Table 2275.1, *Minimum Cover above top of Main Pipe Lines.*

3) Open trench exposure: Once trench is opened, proceed immediately to place specified materials in trench, or to otherwise utilize trench for intended purpose. Long stretches of open trench ahead of pipe laying shall be avoided. Excavating, pipe laying, and backfilling must move forward at approximately equal rates of progress. The Contractor shall only open as much ditch as he can completely install pipe, backfill, compact, and cleanup within that working day. The Contractor shall string out the pipe that can be installed in one day, and no more than 300 feet of trench shall be open in advance of the completed work in any section. There shall be no trenches left open without proper supervision during working hours or after work has been completed for day. Any exception to this construction practice must be approved, in writing, by the Utilities Engineer. Schedule work and order materials so that trenches are not left open for a longer period than is reasonably necessary and do not extend length limits specified in applicable specifications.

4) **Containment of Sediment (solids and mud)**: The Contractor shall at all times so conduct his work to insure that all solids and mud are contained within the trench. This containment shall be by the employment of a brick or block weir or a rock check dam at the junction of new construction and the existing City system in order to trap material for the Contractor's removal and City's inspection prior to acceptance. The installation and removal of this dam shall be at the Contractor's expense and shall be removed before the line is televised.

3.2.4 SHEETING AND BRACING, TRENCH BOXES

A Certified Competent Person designated by the Contractor shall be on-site at all times excavation or pipe installation is being conducted.

All trenching operations require at least one certified construction person on site at all times. Conditions permitting, trench walls may have vertical sides up to a maximum depth of 5 feet above subgrade elevation. Above this depth the entire side must be laid back or either shoring or a trench box, certified for the depths being used, must be used. The contractor shall be required to furnish, put in place, and maintain such sheeting, bracing, etc. as may be required to support the sides of the trenches. Brace and sheet trenches in full observation of OSHA requirements.

Brace trenches running near walls or columns, to prevent any settlement or other disturbance of walls or columns.

Do not remove sheeting until backfilling has progressed to stage that no damage to piping, utility service, or conduit will result due to removal. All shoring and form material shall be removed before backfilling. When sheeting, bracing, or trench boxes are required, in order to prevent damage to existing facilities or structures, or as a matter of safety, or as directed by the Utilities Engineer, the costs are to be included in the unit prices as bid for sanitary sewers, storm drains, water lines or structures as applicable and there shall be no additional cost for these items.

Sloping trench walls: If trench walls are to be sloped or benched, Contractor is responsible for determining the proper and applicable slope based on soil type in order to meet OSHA requirements. Laying back slopes also applies for areas where the top of the trench box is lower than the top of the bank. Contractor shall employ the services of a Geotechnical Engineer for direction and guidance if unstable or difficult soils are encountered. In any event, the Contractor shall hold the City harmless for injuries and/or damages resulting from failure to properly adhere to trench protection regulations/requirements in force at the time of a failure or mishap including, but not limited to, damage to utilities, equipment, structures, paving, etc.

3.2.5 TRENCH ROCK

A. When rock is encountered in the trench, the Utilities Engineer must be notified before any rock is removed.

B. **Rock Excavation/Definition**: Rock excavation shall consist of the removal and satisfactory disposal of all materials, which in the opinion of the Utilities Engineer, cannot be excavated except by drilling, "jack hammering, or hoe ramming" (reasonable production for rock excavation by "jack hammering or hoe ramming" will be defined as 5 or more cubic yards per hour). Rock shall consist of undecomposed stone, hard enough to ring under hammer. All boulders containing a volume of more than one-half cubic yard will be classified as rock. When rock is encountered in the trench, the Utilities Engineer must be notified before any rock has been removed. The Utilities Engineer will measure the rock, after which, the rock shall be excavated to a depth 6 inches below the grade of pipe and the bottom of trench brought back to grade by using an approved fill material.

C. **Cushioning pipe in rock**: Special precautions shall be exercised to prevent any pipe from resting on rock or any other hard projection that might cause breakage of pipe. At no time shall the pipe bell or the pipe barrel rest on rock. A minimum of 6 inches of stone cushioning is required between the barrel of the pipe and rock. A minimum of 12 inches of clearance is required between the sides of the pipe and the rock. Thicker cushioning may be required for deeper pipe on a case-by-case basis.

D. **Disposal of Rock:** Rock excavated from the trench shall be hauled off the site at the Contractor's expense. Borrow required to replace excavated rock shall be provided by the Contractor and shall be included in the unit price bid for rock excavation. No rocks or boulders shall be used as backfill in any part of the trench.

3.2.6 PREPARATION OF FOUNDATION FOR PIPE LAYING

A. Excavation of trenches for all pipes lines shall be done to line and grade as established by the design engineer. The bedding surface shall provide a firm, stable, and uniform support through the entire length of the pipe. Recesses shall be excavated to accommodate bells and joints. When bedded firmly on the subgrade, the pipe shall be on the exact grade of the completed water, sewer, or storm drainage line.

In excavating for the trench, it is essential that the trench bottom be uniform in grade and remains static during backfilling and under all subsequent trench conditions. To insure a uniform depth of stone, the grade of the bottom of the trench shall be graded to within 0.04 foot (1/2-inch) of the plan specified grade. The stone shall be graded to the same tolerance.

Excavation in Class II, III, or IV soils shall be made to grade to provide undisturbed bedding in accordance with AWWA C600.

B. **Unsuitable Trench Subgrade/Foundation Improvement**: Notify the City when unstable materials are encountered and define by drawing station locations and limits where encountered. If the trench subgrade is found to be soft, spongy, excessively wet, unstable or in any other way unfit such that there is inadequate pipe support, when directed by the Utilities Engineer, the material shall be removed for the full width of the trench, and the excavated area shall be strengthened for foundation purposes. The over excavated material shall be replaced with thoroughly compacted Class I, II, or III materials as directed by the Utilities Engineer by furnishing and placing either. Whenever the bottom of the trench is such that it cannot be reasonably stabilized, the Utilities Engineer may require the pipe to be laid in approved crushed stone, a concrete cradle, concrete mud mat, concrete encasement, cradles, cradles supported on piles, or a combination of these materials. When necessary, the Contractor shall provide for the temporary diversion of water in order to maintain the pipe foundation in a dry condition.

B. **Over excavation**: Exercise care to avoid excavations below established grade where firm earth conditions exist. Unauthorized over-excavation consists of removal of material beyond indicated subgrade elevations or side dimensions, without specific approval of the Utilities Engineer. Where unauthorized excavations have been carried beyond points required, restore these areas to the elevations and dimensions shown on the drawings with approved fill material and compact as specified. If over-excavation occurs, such over excavation shall be replaced with clean VDOT #57 stone. In no case shall the pipe be brought to grade by blocking under the barrel of the pipe. A uniform support shall be provided for the entire length of the pipe. Unauthorized excavation shall be replaced at contractor's expense.

3.2.7 DEWATERING

A. When ground water in encountered, the Contractor shall remove the water that accumulates in the trenches or pits, which would affect the construction of the lines or their appurtenances, by pumping, bailing, well-pointing, or other approved dewatering method and shall perform all work necessary to keep the trenches or pits entirely clear from water while bedding is being placed, the pipe is being laid, masonry units are being placed, and structures are either being set or constructed. All water removed from the trench shall be conveyed in a proper manner to a suitable point of discharge and shall comply with applicable erosion and sediment control laws. Pipe laying and pipe jointing shall be made in the "dry."

B. No pipe shall be constructed in water and water shall not be allowed to drain through the pipe. The open end of the pipe shall be kept closed with a tight fitting plug to prevent washing of any foreign matter into the line.

C. No structure shall be constructed in water and water shall not be allowed to flow over or rise upon any concrete or masonry structure until the work has been accepted.

D. The Contractor shall dispose of water from the trenches in such a manner to cause no injury to public health, pubic or private property, work completed or in progress, street surfaces, or which may cause any interference with the use of the streets. Water, if odorless and stable, may be discharged into an existing storm drain, channel, or street gutter in a manner approved by the Utilities Engineer. When required by the Utilities Engineer, a means shall be provided for desilting (filtering) the water before discharge. Under no circumstances shall water be discharged to the sanitary sewer.

E. Prevent surface water from ponding on prepared subgrades and from flooding project site and the surrounding area. Reroute surface water runoff away from or around excavated areas.

F. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

G. Install a dewatering system to keep subgrades dry and convey ground water away from excavations. The cost of shoring, sheeting, well-pointing, gravel bedding and other dewatering devices shall be included in the unit price of each respective item bid. Maintain until dewatering is no longer required.

H. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation. Include cost of de-watering in proposal for water, sewer, or storm drainage lines. No additional remuneration for this item is permitted.

I. Where underground streams or springs are encountered, provide temporary drainage, well-pointing, or bailing. Notify the Utilities Engineer of such conditions.

J. Backfilling shall not take place when the trench contains water in an amount to create soupy conditions.

3.2.8 TRENCH PREPARATION FOR PIPE

A. **Preparation of trenches for Gravity pipelines**

The bottom of the trench for gravity sanitary sewer pipelines shall be excavated to a minimum over depth as shown on **Standard Detail 531.03** to provide for improved pipe bedding material for the entire length of the gravity pipeline, including sewer lateral connections, except in rock where bedding shall be a minimum of 6 inches deep (see paragraph 3.2.5 C, Cushioning Pipe in Rock, above). The bedding shall be shaped so that the bottom half of sanitary sewer pipe rests on the bed. Bell holes and depressions as required of the joint shall be dug after the bedding has been graded and shaped, and shall be only of such length, depth, and width as required for properly making the particular type of joint. The trench for sanitary sewers and lateral connections shall then be backfilled and compacted as indicated in Table 2275.2.

B. **Preparation of trenches for storm drainage pipelines**

The bottom of the trench for storm drainage pipelines shall be excavated to a minimum over depth as shown on the construction drawings in accordance with the applicable laying condition specified (as shown on **Standard Detail 511.01)** to provide for pipe bedding for the entire length of the gravity pipeline, including lateral connections if any, except in rock where bedding shall be a minimum of 6 inches deep (see paragraph 3.2.5 C, Cushioning Pipe in Rock, above). The bedding shall be shaped so to conform to a Type 2 or Type 3 laying condition as may be indicated on the drawings. Bell holes and depressions as required of the joint shall be dug after the bedding has been graded and shaped, and shall be only of such length, depth, and width as required for properly making the particular type of joint. The trench for storm drainage and lateral connections, if any, shall then be backfilled and compacted as indicated in Table 2275.2. Rock larger than 3 inches shall be removed from the trench bottom and any voids filled with Class I, II, or III material. Rock shall be removed 6 inches below pipe and the void filled with clean stone.

C. **Preparation of trenches for Water Mains and Force Mains**

The trenches for water lines and sewage force mains shall be graded to avoid local high points. Trenches shall be graded either level or on a continuous upslope to the high points designated on the drawings. Trenches shall be of such depth as to provide a minimum cover over the top of the pipe as noted in Table 2275.1. The trenches shall have 4 inches of loose soil in the bottom before pipe is placed, so pipe is firmly and continuous in contact with the soil. Pipe shall not bridge any areas. Rock larger than 3 inches shall be removed from the trench bottom and any voids filled with soil or clean stone. Bell holes shall be provided at each joint to permit proper joint assembly and proper pipe support. Rock shall be removed 6 inches below pipe and the void filled with clean stone.

D. **Surface or Ground Water in Trenches/Pipe**

When ground water is encountered, the Contractor shall pump, or otherwise remove any water that accumulates in the trenches and shall perform all work necessary to keep the trenches clear from water while pipe is being laid. No pipe shall be laid in water and the pipe shall not be used as a means of draining ground water from the trench. All water removed from the trench shall be conveyed in a proper manner to a suitable point of discharge and shall comply with the applicable erosion and sedimentation laws. See paragraph 3.2.7 – *Dewatering*, of this specification.

The open end of water or sewer pipe shall be kept closed with a watertight plug to prevent washing of any foreign matter into the line. At the conclusion of the workday, or at any other time when pipe laying is not in progress, a watertight plug shall be placed in the bell of the last joint of pipe laid.

Storm drainage pipe shall either be plugged or an appropriate sediment trap placed at the upstream end to prevent siltation.

3.2.9 TRENCHING IN FILLS

In areas where trenching for pipes will be in fills, the fills shall be brought to an elevation of at least 12 inches above the top of the pipe, and then the trench excavated in the compacted fill, as herein specified for trench excavation.

3.2.10 SUBSURFACE DRAINAGE

Installation of subsurface drainage systems shall conform to the applicable requirements of VDOT *Road and Bridge Specifications*, latest revision using non-woven needle-punched fabric.

3.2.11 EXCAVATION FOR APPURTENANT STRUCTURES

A. Excavate for appurtenant structures to provide a minimum of 3 feet of horizontal clearance between outer surface of the structure and trench wall.

B. Where rock is encountered so that a built-in-place manhole, precast structure (such as a manhole or vault), or other structure will bear over rock, remove the rock to a minimum of 12 inches below the foundation or footing of the structure and place an 12 inch cushion of VDOT #57 stone over the rock.

3.2.12 WATER MAIN BEND BLOCKING INSTALLATION

A. Excavate area to receive poured in place concrete blocking to exact dimensions shown in **Standard Detail 512.01**. Blocking is to be placed in undisturbed residual soils. If blocking is to be placed in areas where boulders or stumps have been removed or in areas of loosely compacted fills, such as in landscaped areas (outside of pavements or parking lots), contact the Utilities Engineer for directions.

B. Concrete shall be plain concrete with a minimum compressive strength of 3000 psi at 28 days.

C. Wrap bolts in plastic or provide other acceptable means of protection, approved by the Utilities Engineer before pouring concrete blocking.

3.2.13 DEPOSITION OF EXCAVATED MATERIAL

A. All excavated material shall be placed in accordance with all applicable OHSA and State and local erosion and sedimentation regulations.

B. Excavated materials shall be so placed as not to endanger the work and so that free access may be had at all times to all parts of the trench and to all fire alarm boxes, fire hydrants and gate valves on water pipes, which are located in the vicinity. Excavated material shall be placed so as to inconvenience the public as little as possible. All fences and walls shall be protected and, if damaged, shall be repaired or replaced in as good or better condition as before it was disturbed. Protect shade trees from stockpiling of material.

C. Exercise care when stockpiling excavated material on the bank in order to prevent surcharging the bank of the trench and potentially rendering the excavation unstable.

3.3 BEDDING

3.3.1 PIPE BEDDING DEFINITIONS: see paragraph 2.1.2, *Pipe Bedding Definitions*

3.3.2 MINIMUM BEDDING REQUIREMENTS (by type of pipe):

A. **Sewer Pipe Bedding**: Provide granular trench bedding material. In no case, unless specifically exempted in writing by the Utilities Engineer, shall the stone bedding be less than the minimum bedding shown in **Standard Detail 531.03**. Unsuitable subgrade shall be improved as directed by the Utilities Engineer.

B. **Bedding Water Pipe, Water Service Pipe, and Sewage Force Mains**: Unless otherwise directed by the Utilities Engineer, do not bed water pipe, water service pipe, and sewage force mains in stone except as indicated for rock areas (see **Standard Detail 511.01**). Where rock is encountered bed in accordance with paragraph *3.2.5 C, Cushioning pipe in rock*.

C. **Storm Drainage Bedding**: Provide granular trench bedding material in accordance with VDOT standard 107.01 and 107.02.

3.3.3 BEDDING FOR STRUCTURES

The bottom of structure excavations shall be excavated to minimum over depth of 12 inches below the bottom of the structure to provide for stone bedding. Bedding material shall be shaped and graded so that the entire bottom of the structure rests on the material for its entire area.

3.4 BACKFILLING (MATERIALS AND METHODS)

A. **General**:

1) **Materials**: See paragraph 2.1.1 - *Material Classification* for Select Earth Backfill and Common Earth Backfill classification. In areas of extensive rock excavation, where there is a shortage of suitable backfill, the Contractor shall, at his own expense, haul suitable material in to be placed over the pipe.

2) Pipe and fittings shall be inspected before backfilling.

3) Except as otherwise specified or directed for special conditions, backfill trenches to the ground surface with Common Trench Backfill material approved by the Utilities Engineer. After the pipe has been brought to grade on a proper foundation, earth fill shall be placed carefully about the pipe and tamped properly to hold the pipe in position. Exercise extreme care in backfilling operations to avoid displacing joints and appurtenances or causing any horizontal or vertical misalignment, separation, or distortion. Repair damages, distortions, or misalignments to full satisfaction of the Utilities Engineer. Pipe shall be removed if broken or damaged during installation. Backfill shall closely follow the pipe installation. Unless otherwise directed or permitted by the Utilities Engineer, all pipe laid shall be backfilled during the same day, and prior to the completion of the day's work, to provide a firm continuous support and covering for the pipe.

4) Reopen trenches that have been improperly backfilled, to a depth as required for proper compaction. Refill and compact as specified or otherwise correct to the approval of the Utilities Engineer.

5) Do not allow or cause any of the work performed or installed to be covered up or enclosed by work prior to required inspections, tests, and approvals. Should any of the work be so enclosed or covered up before it has been

approved, uncover all such work and, after approvals have been made, refill and compact as specified, all at no additional cost to the City.

6) Observe specific pipe manufacturer's recommendations regarding methods of backfilling and compaction.

7) Ensure compaction of each lift to requirements stated in these specifications.

8) All pipe areas shall be graded and maintained in such a condition that erosion or saturation will not damage the pipe bed or backfill.

9) Heavy equipment shall not be operated over any pipe until it has been properly backfilled and compacted with a vibratory compaction device (i.e. Rammax or jumping jack, NO PLATE TAMP) and has a minimum cover as required by the plans. Pipe, which misaligned, shows excessive settlement, or has been otherwise damaged by the Contractor's operations, shall be removed and replaced at no cost to the City.

10) **Installation of Metallic Locating Tape**: All water mains and sewer mains shall have a metallic underground locating tape shall be installed directly over the pipe no more than 12 inches below finished (final design) grade.

B. **Methods**:

1) **Select Earth Backfill**: Furnish select earth backfill where indicated on drawings and specified for compacted backfill conditions up to 12 inches above top of pipe. See paragraph 2.1 *Soil, Bedding, and Backfill* for definition of Select Initial Earth Backfill. Comply with the following:

Care shall be taken to prevent any disturbance to the pipe or damage to newly made joints. The filling of the trench shall be carried on simultaneously on both sides of the pipe in such a manner that injurious side pressures do not occur such that the pipe could be displaced or dislodged. Do not backfill on muddy or frozen soil.

Sheeting and shoring generally should be removed only when the trench below it has become substantially filled, and every precaution shall be taken to prevent any slides of material from the sides of the trench onto or against the pipe.

a. Unless otherwise approved by the Utilities Engineer, place backfill in lifts not exceeding 6 inches (loose thickness).

b. Hand place, shovel slice, and hand tamp carefully compacted backfill solidly around pipe. Only hand tamping shall be used to compact earth around the pipe line. When the backfill has been brought to 12 inches above the top of the barrel, vibratory compaction devices (i.e. Rammax or jumping jacks, NOT PLATE TAMPS) shall pneumatic tampers shall be used to compact the remainder of the soil.

2) **Common Earth Backfill**. Perform remaining backfill in accordance with drawings. See paragraph 2.1 *Soil, Bedding, and Backfill* for definition of Common Earth Backfill. Comply with the following:

a. Unless otherwise specified or approved by the Utilities Engineer, backfill the remainder of the trench, from 12 inches above the pipe to grade, with clean earth fill free of stones larger than 3 inches in diameter. Material shall be free from all perishable and objectionable materials (organic). Before placing any backfill, all rubbish, forms, blocks, wires, or other unsuitable material shall be removed from excavation. The backfilling shall be placed in layers not over 6 inches thick in the street right of way and 12-inch layers outside of the street right of way. See Table 2275.3. Final backfill shall be tamped with a vibratory compaction device (i.e. Rammax or jumping jack, NOT A PLATE TAMP). See Table 2275.2 below, for specific density requirements.

b. All areas within the limits designated on the drawings, including adjacent transition areas, shall be uniformly graded. The Contractor shall finish surfaces within the specified tolerances with uniform levels or slopes between points where elevations or existing grades are shown.

1. Finish subgrade areas that are to receive topsoil. Bring such areas to within 0.10 foot of required subgrade elevations.

2. Shape subgrade under sidewalks to line, grade, and cross-section. Subgrade is to be brought to within 0.10 foot of required subgrade elevations.

3. Shape subgrade under pavement to line, grade, and cross-section. Bring to within ½ inch of required subgrade elevations.

c. **Surface Protection – Traffic**: The Contractor shall protect newly graded areas from traffic and erosion and repair and re-establish grade in settled, eroded, or rutted areas. Where compacted areas are disturbed by subsequent construction or adverse weather, the Contractor shall scarify the surface, reshape, and re-compact to the required density. If the Contractor shall fail to maintain any trench within 2 days after receipt of written notice from the Utilities Engineer, the Utilities Engineer may refill the said depressions and the cost of such work may be retained from monies due the Contractor or billed directly to the Contractor. In case of emergency, the Utilities Engineer may refill any dangerous depressions without prior notice to the Contractor.

3) **Structure Backfill**: Backfill placed within 2 feet of manholes and other special structures shall be of the same quality as that specified for backfill around water, sewer or storm drainage lines. Take care to prevent wedging action of the backfill against structure by carrying the material uniformly around the structure so approximately the same elevation is maintained in each lift. Material shall be solidly tamped with a mechanical or pneumatic tamper in such a way as to avoid damaging the structures or producing unequal pressures. The Contractor shall refill all excavations as rapidly as practical after completion of the structural work therein, or after the excavations have served their purpose.

4) **Aggregate Backfill**:

a. **Dense Graded Aggregate Backfill**: When select earth backfill/borrow cannot be obtained, dense graded aggregate may be substituted with the Utilities Engineer's approval.

b. **Coarse Aggregate Backfill**: In confined areas where compaction cannot be achieved, coarse aggregate may be substituted with the Utilities Engineer's approval.

3.5 COMPACTION/DENSITY

Soil shall be compacted using equipment suitable for the material and the work area location. Power driven hand tampers shall be used for compacting materials adjacent to structures. Use hand tamper for recompaction over underground utilities.

A. **Testing**

Testing of backfill shall be performed by an independent laboratory approved by the City and the Contractor. The Contractor shall be responsible for excavation for testing.

Quality Assurance vs. Quality Control:

Quality Assurance (QA) testing, and the associated cost, is the responsibility of the City. Quality Assurance testing by the City is used to confirm that the Contractor is generally performing his/her work in compliance with these specifications.

Quality Control (QC) testing is the necessary and required testing that is to be performed by the Contractor to assure that he/she is meeting and complying with the requirements of these specifications. The associated cost for QC testing is the contractor's responsibility. The Contractor is also responsible for "re-testing" costs incurred by the City when the City test results (tests for Quality Assurance) results in a "failure."

B. **Quality Assurance (QA):**

In the course of backfilling trenches for utility installations, the Utilities Engineer may require "Field Density Determinations" or compaction tests. When compaction tests are called for, the Utilities Engineer will determine the location of the tests and the City shall engage a qualified testing firm to perform the test. Field density determinations shall be performed in accordance with AASHTO T191, T205, and T214, modified to include material sizes used in the laboratory determination of density with nuclear field density testing device or by other approved methods. A representative of the City will observe tests and a copy of the test results and inspection report will be submitted by the testing firm directly to the Utilities Engineer. When the average of 3 test results, with no one test failing by more than 3 percentage points, indicate that the density is less than the percent specified, the Contractor shall excavate and re-compact the areas that have failed at no expense to the City. Payment for failed compaction test shall be made by the contractor by deducting the cost from the forthcoming retainage or billed directly to the Contractor.

C. **Quality Control (QC):**

For City funded projects, the cost of Quality Control testing shall be included in the bid prices for water and/or sewer installation. However, where backfill compaction is suspect and questionable, the material shall be removed as directed by the Utilities Engineer and the area tested. If a suspect area fails to meet the prescribed minimum moisture density test requirements, the soil shall be removed, replaced, compacted, and re-tested, as directed by the Utilities Engineer, until the backfill meets or exceeds the minimum density requirements. The Contractor shall pay for all costs associated with re-testing.

Testing Frequency	
Location	**Frequency**
Trench areas in road crossings	1 per road crossing, and/or
Trench areas	1 per 100 linear feet per six inches of fill thickness
Exception: Where additional tests are required to determine the extent of unacceptable compaction (having been determined by the initial QA/QC test). In this case, the costs for these additional tests are the responsibility of the Contractor.	

D. **Site access for testing**: Ensure City, at all times, has immediate access to the site for the testing of all soils related work. Ensure excavations are in a safe condition for testing personnel.

E. **Compaction Requirements:** Unless noted otherwise on drawings or more stringently by other sections of these specifications, place and ensure backfill and fill materials achieve an equal or "higher" degree of compaction than undisturbed materials adjacent to the work; however, in no case shall degree of compaction fall below the following percentages of the maximum density at optimum moisture content. Tolerance is to be within +/- 3 percentage points of the optimum moisture content.

Table 2275.2 **Minimum Compaction Limits** **(Cohesive Soils)**		
Location	**Density**	
Areas under roadway pavement surfaces, curb and gutter, and sidewalks	Top 12 inches	100% of the maximum dry density by ASTM D698 (Standard Proctor), AASHTO T99.
	Up to within 12 inches	95% of the maximum dry density by ASTM D698 (Standard Proctor), AASHTO T99.
Roadway shoulders	95% of the maximum dry density by ASTM D698 (Standard Proctor), AASHTO T99.	
Under turf, sodded, planted, or seeded non-traffic areas	90% of the maximum dry density by ASTM D698 (Standard Proctor), AASHTO T99.	
Beneath and within 25 feet of buildings	100% of the maximum dry density by ASTM D698 (Standard Proctor), AASHTO T99.	

F. **Compaction Lifts**:

Table 2275.3	
Compaction Lift Thickness of Common Earth Backfill	
Lift Thickness (inches)	**Location**
6	Inside street rights-of-way
12	Outside street rights-of-way

G. In-place testing of soils shall be tested based on the following:

Table 2275.4	
In-Place Density Tests	
Soil Type/Classification	**Reference Standard**
Crushed Rock	ASTM D 2049 by percentage of relative density ASTM D 1557 or D 698 (standard Proctor)
GW, GP, SW and SP	ASTM D 2049 by percentage of relative density ASTM D 1557 or D 698 (standard Proctor)
GM, GC, SM, SC, ML, CL	ASTM D 2167, D1556, D2922, or D2937 by percentage of Standard Proctor Density according to ASTM D 698 or AASHTO T99

3.6 SERVICE CUTS, DIRECTIONAL BORED OR PUNCHED SERVICES

A. **Open trenches**: Sewer lateral and water service connections that cross paved streets shall be installed by saw cutting the pavement and opening the trench.

Lateral and service connection trenches shall be backfilled as specified for gravity sewers and for water lines, as applicable. See Table 2275.1.

Do not bend water service pipe, except when rock is encountered.

B. **Directional Boring or Punching**: At the direction of the Utilities Engineer, service pipes may be required to be "punched" or "directional bored" beneath the pavement.

3.7 PAVEMENT REPAIR AND REPLACEMENT

A. **General**: This work shall consist of replacing subbase stone, and bituminous material in the street in areas where it becomes necessary to remove the original pavement for sewer, water main, and storm drainage trenches. Pavement repair shall be as shown on the drawings, or as determined by the Public Works Director. The pavement patch shall provide a uniform and smooth driving surface free of humps or depressions.

B. **Construction in Public Rights of Way**: Water, sewer, and storm drainage lines installed in or across VDOT roads shall be installed in accordance with, if applicable, the requirements stipulated in the approved encroachment permit and the latest requirements of both the VDOT Road and Bridge Specifications and the Roadway and Bridge Standards Volume I and II. All water, sewer, and storm drainage lines installed in or across City streets shall be in accordance with these specifications and the applicable standard details.

When it is necessary to remove the existing pavements, prepared road surfaces, sidewalks, or curbing, it shall be the responsibility of the Contractor to replace these surfaces to original or better condition. The Contractor shall be

responsible for contacting the City or the VDOT, as applicable. Unless specified more stringently by the owner of the right of way, the backfill shall be compacted in accordance with Table 2275.2.

Contractor shall replace pavement base with a minimum of 8 inches of ABC compacted to 95% of the Standard Proctor (ASTM D698) maximum dry density prior to pavement overlay.

C. When water, sewer and/or storm drainage lines are installed in or across roadways that have been macadamized or graveled, the Contractor shall save the gravel or stone and refill the upper 12 inches of the trench with the material and supply sufficient new stone or gravel to return the roadway to the original grade. It shall be the Contractor's responsibility to maintain the original grade by adding gravel or ABC until the ditch is stable and the pipeline accepted by the City. Maintain area as outlined in paragraph 3.1.4 B – *Protection of Surface Features*.

D. **Cutting Pavement**: See also paragraph 3.1.4 B – *Protection of Surface Features*. Perform cutting operations prior to installation of line to avoid excessive removal of asphalt.

E. **Protection of Pavement**: See paragraph 3.1.4 B – *Protection of Surface Features*.

F. Refer to specification Section 02740 – *Base Coarse and Paving*.

3.8 ROCK

3.8.1 Rock Excavation – Definition: See paragraph 1.3 E for definition of rock excavation.

3.9 RAILROAD CROSSING/TRACKS

Crossing of railroad tracks with water, sewer or storm drainage lines shall be by the method shown on the contract drawings and approved by the applicable Railroad Company. It is the responsibility of the Project Engineer and Contractor to contact the Railroad Company and to comply with all Railroad Company requirements for specifications, drawings, permits, etc. All water, sewer, and storm drainage lines installed beneath railroad tracks shall be in accordance with the Railroad Company's policies, procedures, and permits requirements. The railroad right of way and track structure shall be fully restored to its original pre-existing condition and to the full satisfaction of the Railroad Company. The work shall not interrupt the use of the railroad tracks or in any way endanger the traffic on them.

3.10 HIGHWAY CROSSING

A. Pipeline crossing shall be installed in a steel casing pipe installed by the "dry bore and jacking" method. Length of steel pipe shall be welded to the preceding length installed. The carrier pipe shall be protected by spiders. The ductile iron carrier pipe shall be as specified for sewer and water pipe and shall be slip joint ductile iron pipe. If, in the opinion of the Contractor, boring and jacking of the highway crossing is not possible due to rock, he shall test drill, in the presence of the Utilities Engineer at the proposed crossing locations, at least 3 evenly spaced points in the placement along the crossing alignment. Upon verifying the

presence of rock at a depth that would conflict with the boring and jacking operation, the Contractor shall make application to the applicable City or the VDOT, as applicable, to allow open cutting of the crossing. The Contractor shall be responsible for providing all data and shall pay any fees required for this application. If the trench is allowed to be open cut, casing pipe shall be provided and the trench shall be backfilled entirely with flowable fill concrete to the bottom of the pavement base course and the pavement restored within one day of placing the pipe. Non-woven fabric separation fabric is to be provided between the stone and the pavement.

B. The steel casing pipe shall be of the thickness as shown on the drawings. Refer to specification Section 02530 – *Sanitary Sewer* and Section 02510 – *Water Distribution* for casing pipe specifications.

C. Installation shall be in accordance with AREA.

D. The jacking operation shall be carried on in such a manner that settlement of the ground or the highway above the pipeline will not occur. The use of water or other fluids in connection with the boring and jacking operation shall not be allowed. Excavation shall be made by auger or manual methods, at the Contractor's option, to suit the conditions encountered. The contractor shall repair or replace, as directed by the Utilities Engineer, at his own expense, casing pipe damaged during the jacking operation.

E. After installation of the casing pipe, the carrier pipe, if required, shall be installed. The ends of the casing shall be plugged.

F. All operations of the Contractor shall be subordinate to the free and unobstructed use of the highway right of way for passage of traffic without delay or danger to life, equipment, or property. The Contractor shall provide all necessary bracing, bulkheads, and shields to ensure complete safety to all traffic at all times.

3.11 UNDERGROUND RIVER OR CREEK CROSSINGS

River or creek crossings shall be as near to perpendicular as possible to the stream.

A. **Cofferdam Method**: The Contractor shall construct the river crossing in the "dry" by providing a temporary cofferdam or bulkhead of non-erodible material. The cofferdam shall not obstruct more than one-half of the water surface at any time and shall not extend more than 3 feet above the normal water surface. The Contractor shall not be allowed to operate construction equipment on the native steam bottom, except during removal of the cofferdam. The Contractor shall be advised that the level in the river can fluctuate rapidly.

1) Non-erodible material shall be defined as heavy coarse aggregate as specified on the plans. An earth core for the cofferdam may be constructed over the propose excavations; however, the non-erodible materials shall be in place prior to the placement of the earth, so that the erodible earth does not come in contact with the flowing water.

2) A bulkhead may be constructed in lieu of the cofferdam. The bulkhead shall be made of wood, steel or some like material suitable to withstand the hydraulic forces to permit construction in a dry trench.

3) Construct the crossings as indicated. The Contractor shall then remove the cofferdam, bulkhead, or whatever equipment or material that was used to construct the crossing. The bottom of the river in the construction area shall be restored to its original cross section. All disturbed areas on the banks of the river shall be seeded and mulched in accordance with Section 02920 – *Seeding, Sodding, and Groundcover*.

4) Comply with all terms and conditions of all permits issued by the US Army Corps of Engineers, DCR, and/or DEQ for this work.

5) The pipe and joints of water or sewer main entering or crossing streams shall be tested in place and shall exhibit zero infiltration. This testing shall be done prior to encasing in concrete.

3.12 SURFACE WATER CROSSINGS

Surface water crossings, with pipe above the water, shall be adequately supported by pipe support piers or beams**.** Surface water crossings with pipe under streambed shall have the pipe encased in concrete when the cover is less than 3 feet.

3.13 CONCRETE COLLARS ON SEWER MAINS

Concrete collars shall be used on sewer lines with slopes 20% or greater. At least one concrete collar shall be placed before the bell of each joint of pipe. Additional collars may be required by the City.

3.14 PLACEMENT OF RIP RAP AND RIP RAP BEDDING

Placement of Rip Rap shall conform to Section 204, *Stone for Masonry, RipRap, Porous Backfill and Gabions* and Section 414*, Riprap* of the VDOT *Road and Bridge Specification*, latest revision.

3.15 SEEDING, SODDING, AND GROUNDCOVER

Refer to specification Section 02920 – *Seeding, Sodding, and Groundcover*.

3.16 CLEANUP AND RESTORATION OF SITE

A. During the progress of the work, the Contractor shall keep the premises and the vicinity of the work clear from unsightly and disorderly piles of debris. Suitable locations shall be specified for the various construction materials and for debris. The materials shall be kept in their storage locations, except as needed for the work and debris shall be promptly and regularly collected and deposited in the specified location.

B. Upon completion of section of pipeline and appurtenances, the Contractor shall fine grade the ground adjacent thereto, removing all surplus excavated material, leaving the area free from surface irregularities. He shall dispose of all surplus material, dirt, and rubbish from the site; and shall keep the site free of mud and dust to the satisfaction of the Utilities Engineer. The Contractor may be required to flush or sprinkle the street to prevent dust nuisance.

C. When working on the shoulders of paved roads, the Contractor shall keep the pavement clean of all loose earth, dust, mud, grave, etc., and shall restore road surfaces, shoulders, and ditches as required by either the VDOT or the right-of-way owner.

D. **Grading Easements**: Easements shall be graded to have cross slopes of 4% or less. The ground surfaces of easements shall be graded and cleared in such a way to promote proper drainage and allow mowing by vehicular equipment without damage to equipment from rocks and other debris.

E. After all work is completed, the Contractor shall remove all tools and other equipment, leaving the site free, clean, and in good condition.

F. The Contractor shall keep the surface over and along the trenches and other excavation in a safe and satisfactory condition during the progress of the work and for a period of one year after the work has been competed. He shall be held responsible for any accidents that may occur on the account of the defective condition of such surface.

3.17 MISCELLANEOUS

3.17.1 IDENTIFICATION OF NEW SANITARY SEWER LINES (Metallic Locating Tape)

Placement of locating tape during backfill operations shall be required on all newly installed non-metallic mains and service laterals. The metallic locating tape shall be per paragraph 2.2.2 of this specification and located no more than 24 inches below the final grade (See **Standard Detail 531.03**).

3.17.2 FLOWABLE FILL CONCRETE BACKFILL

When directed by the Utilties Engineer, the Contractor shall backfill trenches or undercut areas with flowable fill concrete plant mix. Except for structural applications, traffic can be placed on mixture within an hour or two after placement. Final surfacing of pavements; however, should be delayed if possible at least 24 hours to allow for shrinkage and hydration of concrete. Settlement of 2 to 3 inches is to be expected.

3.17.3 SALVAGE OF USEABLE MATERIALS

Useable materials include paving blocks, paving brick, castings, and pipe etc., removed during excavation that is useable on this project or future projects as determined by the City Engineer or Utilities Engineer. Such material shall be stockpiled on site or as directed by the City Construction Coordinator at no additional cost to the City. Unnecessary abuse and damage to these items shall be the Contractor's responsibility and the cost of replacement may be deducted from the retainage.

End of Section 02275

Back to Top

bj.Fairfax – Manual.Specs.FFdv02275UtilTrench.doc

Things to check in final edit:

- Coordinate 02530 Sanitary Sewer & 02510 Water Distribution with this spec (accuracy and continuity).
- Table numbering sequence
- Paragraph numbering sequence/continuity.
- Indentions, etc.
- Table references correct
- Check for split tables
- Standard Detail references
- Paragraph references.
- Spelling
- Draft number removed
- Revision Date
- Footing Date
- Hyphenation
- Intra-spec and external Hyperlinking